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ELECTRIC DATA PROCESSING IN THE NAVY SUPPLY AND FINANCIAL SYSTEM

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NAVY GRADUATE COMPTROLLERSHIP PROGRAM

ELECTRONIC DATA PROCESSING IN THE NAVY SUPPLY AND FINANCIAL SYSTEM

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Prepared for

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PREFACE

There are relatively few Supply Corps Officers in the Navy who have the barest essential knowledge of Electronic Data Processing and its application to the Navy Supply System. Electronic Data Processing is new, and it is necessary that more Supply Officers become qualified in the general phases of this field.

In the preparation of this paper, the author has attempted to acquire a general knowledge of Electronic Data Processing and its application in the Navy Supply System, and to explain the systems in a manner to facilitate ease in the reading and understanding of the systems. The majority of the existing information on this subject is written using technical terms which readers shun or do not understand.

There is a lack of published material on Electronic Data Processing, and only the recently published material is not yet outdated. All material must be studied to ascertain whether or not it is still current.

Acknowledgment is made to the personnel of the Data Processing Branch of the Inventory Control Division, Bureau of Supplies and Accounts, under Lieutenant Commander N. T. Hawkins, Supply Corps, U. S. Navy, and the personnel of his office; Mr. O. Gossett; Mr. R. L. Lambert; and Mr. R. Unzicker for their

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generous assistance in making available their complete files on Electronic Data Processing and for the aid rendered the author in explanations and advice on the subject.

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INTRODUCTION

In the past few years the economy of this country has grown more complex as corporations have increased in numbers, size, products produced, and in the extent of their markets. Along with this growth, we have witnessed the introduction of mass production and revolutionary business techniques. This growth has resulted in a spectacular increase in the volume of papers to be processed and the number of records to be maintained. While the larger corporations were emphasizing production efficiency and improved merchandising techniques, many were overlooking the increased costs of information gathering, communication processes, and record keeping.

The development of the electronic computer has opened a new field for management with the increase of office efficiency and the unification of data processing throughout the organization. An electronic computer system can:

1. Increase transmission, processing, and reproductive speeds.
2. Reduce the need for manpower.
3. Reduce storage space requirements.
4. Automatically handle steps in data processing,

giving more flexibility in the preparation of a variety of reports, while at the same time increasing accuracy.[1]

While this growth was taking place in the business world, the U. S. Navy experienced a tremendous growth in size for World War II, and since that war it has been unable to reduce to its pre-war size due to national security commitments. The Navy's growth has not been limited to size alone, but it has become more complex due to the technological development of numerous equipments and the requirements for more extensive and accurate records. Top management of the Navy has recognized the need for more efficient paper work methods and better reporting systems. The Navy Supply System offers the greatest opportunity for electronic computers to increase management control efficiency in stock control and financial control operations.

This paper will provide an introduction to electronic data processing machines and their applications in the Navy's Supply and Financial Systems. Also plans for future adoption of electronic computers in these systems are discussed. The financial economies and increased management control afforded by the computer systems will contribute to reaching the Navy's objective of providing the country with the maximum defense for every defense dollar expended.

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[1] G. Kozmetsky, and P. Kircher, Electronic Computers and Management Control (New York: McGraw-Hill Book Co., 1956), p. 1.

CHAPTER II

ELECTRONIC DATA PROCESSING MACHINES

DEVELOPMENT

Electronic data processing machines used during World War II were machines developed by Professors Eckert and Mauchly of the University of Pennsylvania. The machines were used for scientific computations only until 1950. By 1951, the International Business Machines Company had developed a machine for scientific computations and had delivered twelve of these machines by 1953. Remington Rand purchased the company formed by Professors Eckert and Mauchly and produced the first machines for business purposes. In this field they surpassed International Business Machines, who had no business machine at the time. In 1954, International Business Machines produced the IBM 701 for scientific purposes and the IBM 702 for business needs. Other major companies have also produced machines for both scientific and business purposes that are favorably competing with IBM and the Sperry-Rand machines.

The electronic data processing machines (hereafter termed EDPM) were not invented or developed at once. They represent the results of man's desire to solve problems more easily and to do his work in the most efficient manner available.

The earliest labor saving device for calculating was the abacus which was used by the Hindus and later by the Greeks in the teaching of geometry and mathematics. As business developed throughout the ages, men have been using various methods of calculating, but practically nothing in the form of labor saving devices was invented prior to the 20th century. The typewriter, the adding machine, the addressograph, and the calculator have all been developed within a relatively short span of years.

The office machines used prior to the advent of the electric accounting machines were limited in the scope of what they could do, and the small number of operations they could perform with the further limitation of performance without human intervention. The other characteristics limiting their usefulness are their limited ability to perform operations in sequence, their limited capacity to store data for future use, and frequently their destruction of basic data after performing an operation. The electric accounting machines are a major improvement over the basic labor saving machines, but their capabilities are also limited. Electric accounting machines are used most efficiently when repeating the same operations on large volumes of data. This leads to the dividing of the data into batches for the accomplishment of the machine operation routines. On these batches, some of the required operations are performed on the electric accounting machines, some by the use of the labor saving devices, and some steps are accomplished manually. Table 1 illustrates the number of separate steps

required for processing a requisition at a stocking activity in the Navy Supply System equipped with electric accounting machines. This list is not 100% complete as it omits the statistical accounting data compilation, summarization, and analysis required. The processes listed in Table 1 can be accomplished in slightly less than twelve hours, which until recently has been considered to be a truly noteworthy accomplishment.

TABLE 1

SUPPLY ACTIVITY OPERATIONS IN PROCESSING REQUISITIONS[a]

1. Requisitions received in Issue Control Section.
2. Requisitions counted in various categories. (Several operations)
3. Requisitions reviewed for completeness, and scheduled shipping date and number of line items entered on each. (3 operations)
4. Requisitions sorted into batches by cognizant Stock Unit.
5. Batches sequenced on first stock number.
6. Invoice number stamped on each requisition.
7. Accounting information verified and BSCC assigned. (2 operations)
8. Dummy header card key-punched.
9. Dummy header card key-verified.
10. Detail cards reproduced from dummy header cards.
11. Cards and requisitions matched, sorted for each reviewer. (2 operations)
12. Stock reviewer takes action. (Several operations)
13. Requisitions reviewed for possible change in accounting data.
14. Second header card for invoice key-punched.
15. Second header card key-verified.
16. Stock reviewer pulls all offset balance and detail cards.
17. Balance card and mark-sense data reproduced into detail cards.
18. Above punching verified.
19. Transaction Register run off and new balance card summary-punched.
20. New balance cards interpreted.

TABLE 1-Continued

21. TR proof listing run off; statistical totals accumulated.
22. Detail cards separated from old balance cards.
23. Detail cards interpreted.
24. Issue detail cards separated from others.
25. Issue detail cards requiring invoices separated from others.
26. Quantity and unit price multiplied.
27. Multiplication verified.
28. Cards sorted into invoice number sequence.
29. Second header cards sorted into accounting number sequence.
30. Second header cards merged with master activity name cards.
31. First header cards reproduced from merged deck.
32. Second header and master activity name cards separated.
33. Master activity name card file merged back together.
34. First header cards interpreted.
35. Second header cards interpreted.
36. First and second header cards merged together.
37. Header cards sorted into invoice number sequence.
38. Header and detail cards merged together.
39. Invoices run, simultaneously punching financial detail card.
40. Accumulated requisitions sorted into invoice number sequence.
41. Requisitions matched with invoices.
42. Invoices verified against requisitions. (Several operations)
43. Invoices separated for distribution.
44. Requisitions and file copy of invoice sorted into requisition number sequence.
45. Requisitions and file copy of invoice filed.
46. New balance cards filed by stock reviewer.
47. Warehouse copies of invoices sorted into groups by warehouse

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[a] U.S., Navy Department, Bureau of Supplies and Accounts, *Introduction to Electronic Data Processing Machine Applications. NAVSANDA Publication 283*, 1955.

In the handling of data on a compartmented operational procedure basis (batches), the indirect results or limitations usually encountered are:

1. Each additional extraction of information desired from the basic data requires one or more additional operations;

2. The mental outlook of those developing or reviewing the procedures and of those responsible for smooth operations has been responsible for many of these persons thinking only in terms of the process and not in terms of the systems, functions, and objectives;

3. The processing of exceptional cases tends to be inefficient and time consuming;

4. This method causes a constant physical movement of papers from one point to another with waiting time between each processing, so actually the result is that only about 1% of the time required to process an invoice "normally" is actually the processing time.

Electronic data processing machines have characteristics and design that are entirely different from those machines previously used for data processing. The EDPMs will overcome many of the difficulties encountered by electric accounting machines, but the one basic product or improvement they offer is speed. Even though the other benefits center around speed, they cannot be considered unimportant.

Computers and Data Processing Machines

Electronic data processing machines (sometimes called automatic data processing machines, automatic business computing machines, electronic brains, giant brains, etc.) are devices

that are capable of performing internal arithmetical and logical operations on numerical and alphabetical data. These machines also have the characteristics of having instructions or orders telling the machine the operations to perform stored within them in exactly the same manner as the data to be operated upon.

In order to understand EDPMs, much more than definitions are needed. There are two general types of computers, the general purpose type and the special purpose type. The general purpose computer is the data processing center, completely integrated, and able to perform functions of data processing as:

1. Receiving information;
2. Converting information;
3. Sorting data;
4. Collating data;
5. Computing data;
6. Transmitting data; and
7. Putting data in a usable form as the printed output.

The special purpose machines are those limited to the type of computations or to the functions they can perform. These machines are designed to handle separate aspects of data processing as recording the number of telephone calls and computing the monthly telephone bills.

In order to operate effectively the EDPM must:

1. Provide a method for getting the data into the

machine--the INPUT;

2. Provide a method of getting the answers out--the OUTPUT;

3. Be equipped to store data on which it is working or may need for future work--the STORAGE;

4. Have a unit in which it performs its arithmetic and logical operations--the ARITHMETICAL-LOGICAL UNIT; and

5. Have a means of determining what operations it is to perform and controlling their sequence--the CONTROL UNIT.

The terms "electronic data processing machines" and "electronic computers" are often used as common terms with the same meaning; however, there are definite differences involved. The EDPM always has a method for storage, as the magnetic tape, but the computer frequently does not. The EDPM has a much more flexible input and output equipment than a computer. Computers usually handle only numeric data while the EDPM also handles alphabetic and special character information. In the operations of the machines, the computer is designed to handle involved mathematical computations while the EDPM is designed to handle business operations. EDPMs usually operate at lower internal speeds than computers, but they have faster terminal equipment to provide for faster input and output of large volumes of data. The applications in the Navy Supply System require the use of EDPMs of the general purpose class.

The general business abilities of the machines have been mentioned, but as the gathering of business data, processing the data, and the transmitting of the information

within the company are so general, some of the specific business applications of the EDPMs should be considered. Some of these are:

1. Payroll processing;
2. Billing;
3. Accounts receivable maintenance;
4. General accounting;
5. Cost accounting;
6. Labor distribution;
7. Accounts payable;
8. Budgeting;
9. Inventory control;
10. Manufacturing scheduling;
11. File maintenance;
12. Report preparation;
13. Sales analysis;
14. Job control;
15. Shop scheduling;
16. Operational analysis; and
17. Programming.

There are other applications for the EDPMs, and these will be developed within the organization according to the needs of the business and to the skill of those using the machines.

Types of Machines

The principle electronic business computers can be divided into four classes:

1. The Large size costing about $1,000,000 or more;
2. The Medium size usually ranging from $50,000 to $500,000;
3. The Small size costing $50,000 or less; and
4. The Special Purpose machines with an indefinite price range.

Table 2 shows the major equipments, with manufacturers, approximate costs for rental or purchase, and an indicator denoting whether they are Large, Medium, or Small.

How the Computers Operate

The electronic data processing machines are basically simple, but in order to understand how they operate the language of the computer must be understood. In one system, the switching of the elements of the computer can either be opened or closed, therefore, the language of the computer must conform to a system utilizing these two positions. This is called the system of binary numbers, and it involves the conversion of all input and output data to and from binary numbers. This system was used in the early days of computer development as it made computer design easier and the computers cheaper to build.

For business applications, it has been found that the decimal system of counting or numbering is a more efficient language for the computer. This system eliminates the time required for conversion to binary numbers, decreases programming time, and decreases trouble shooting time during operations.

TABLE 2

ELECTRONIC DATA PROCESSING MACHINES

Manufacturer	Size	Model	Price	
			Rent per month	Buy
1. ALWAC CO.	M	ALWAC 800	. . . . .	$125,000
(Logistics Research Inc.)	M	ALWAC III, IIIE	$1,775	48,000
2. Bendix	M	G 15A	1,500	50,000
3. Burroughs	M	DATATRON 205	3,900	135,000
	L	220		
	S	ELECTRODATA E101	915	35,100
4. Electronic Engineering Corp		Language Translator ZA-100		
5. Ford Motor - Aeronutronic Division	L	ASI 505	29,000	1,100,000
6. IBM	L	704	37,000	On application
	L	705	33,000	On application
	L	709	56,000	3,000,000
	M	650	3,750	Application
		RAMAC 304		
7. Marchant*	M	MINIAC		85,000
8. Minneapolis-Honeywell:				
Raytheon	L	DATAMATIC	30,000	1,500,000
9. Monroe	M	MONOROBOT VI		75,000
10. National Cash Register	M	NCR 304	May rent	140,000
11. Philco	L	TRANSAC S-2000	20,000	1,000,000
12. R.C.A.	L	BIZMAC		1,200,000
13. J. B. Rea Corp.	M	READIX	3,970	91,000

TABLE 2-Continued

Manufacturer	Size	Model	Price	
			Rent per month	Buy
14. Royal McBee Corp.	S	LGP-30	$915	$35,000
15. Sperry Rand	L	UNIVAC I	25,000	1,000,000
		II	30,000	1,200,000
	L	Scientific 1103A	25-30,000	1-2,000,000
	M	UNIVAC 0 & I File Computer	5-10,000	250,000
16. Stanford Research Corp.		ERMA (Special Purpose) (Bank of America		
17. Stewart Warner	S		22,500	
18. Stromberg Carlson	High Speed Electronic Printer	SC 5000	4,500	150,000 Hc
19. Underwood	M	125	8-10,000	300,000

* Have discontinued production due to high cost.

Fig. 1.-Large Type Computer System

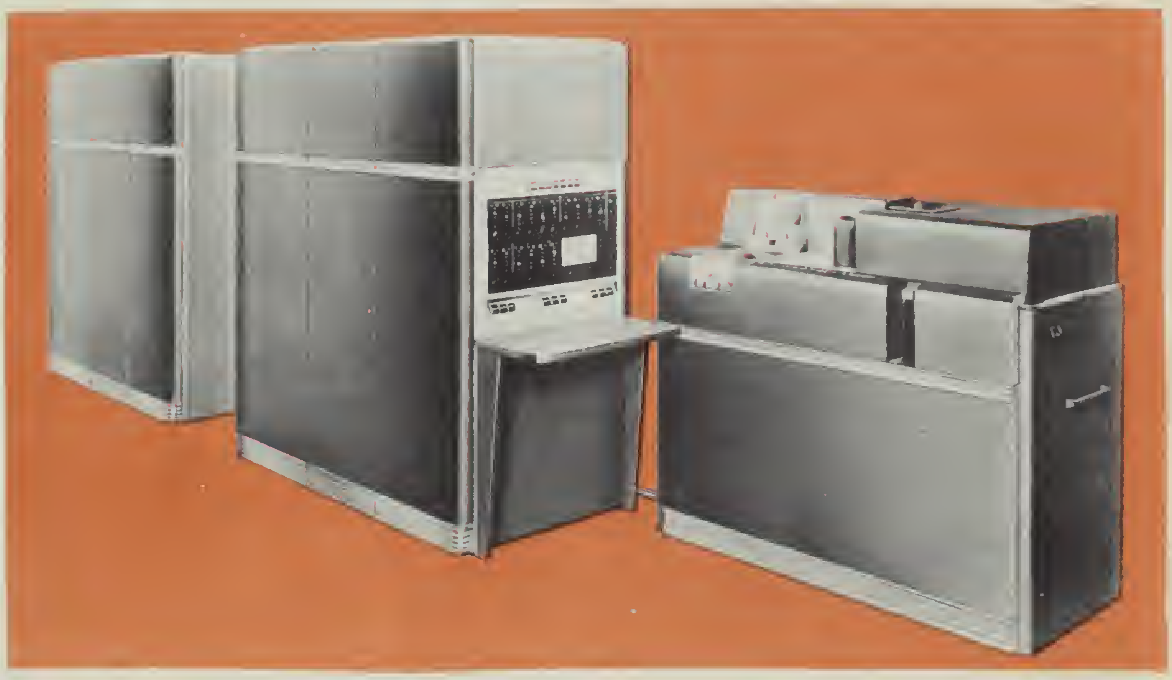

Fig. 2.-Medium Type Computer System

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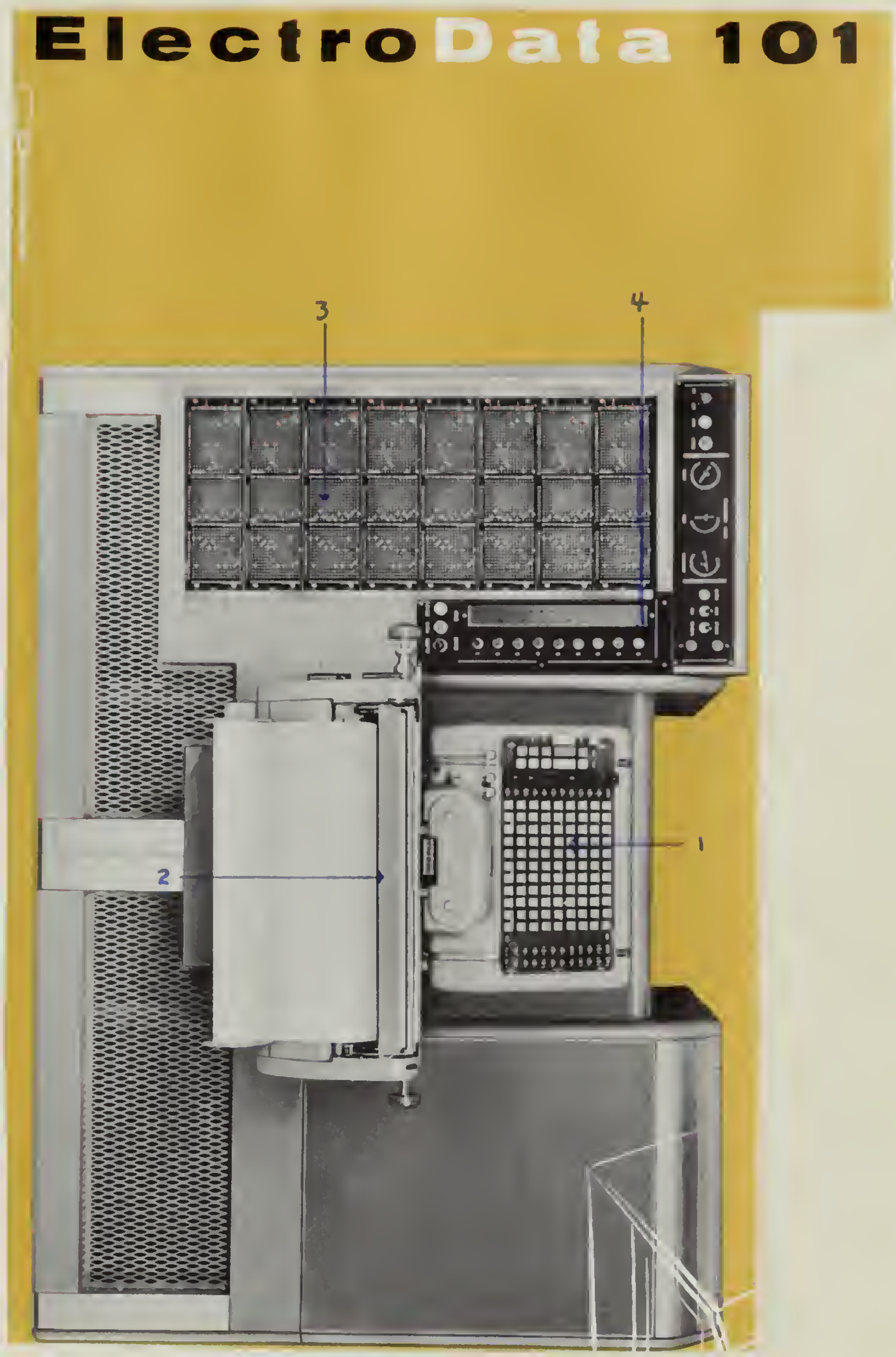


Fig. 3.-Small Type Computer System. The principle parts are:

1. Keyboard;
2. Printer;
3. Pinboard;
4. Control Panel.

For business applications the decimal system should be used. Up to the present time, most computers built utilized the binary numbering system, but the turn is now to the decimal computers, and those using the binary computers in business are almost unanimous in their desire to secure a decimal computer.

The operations of the computer center around the five requirements, Figure 4, necessary for computers:

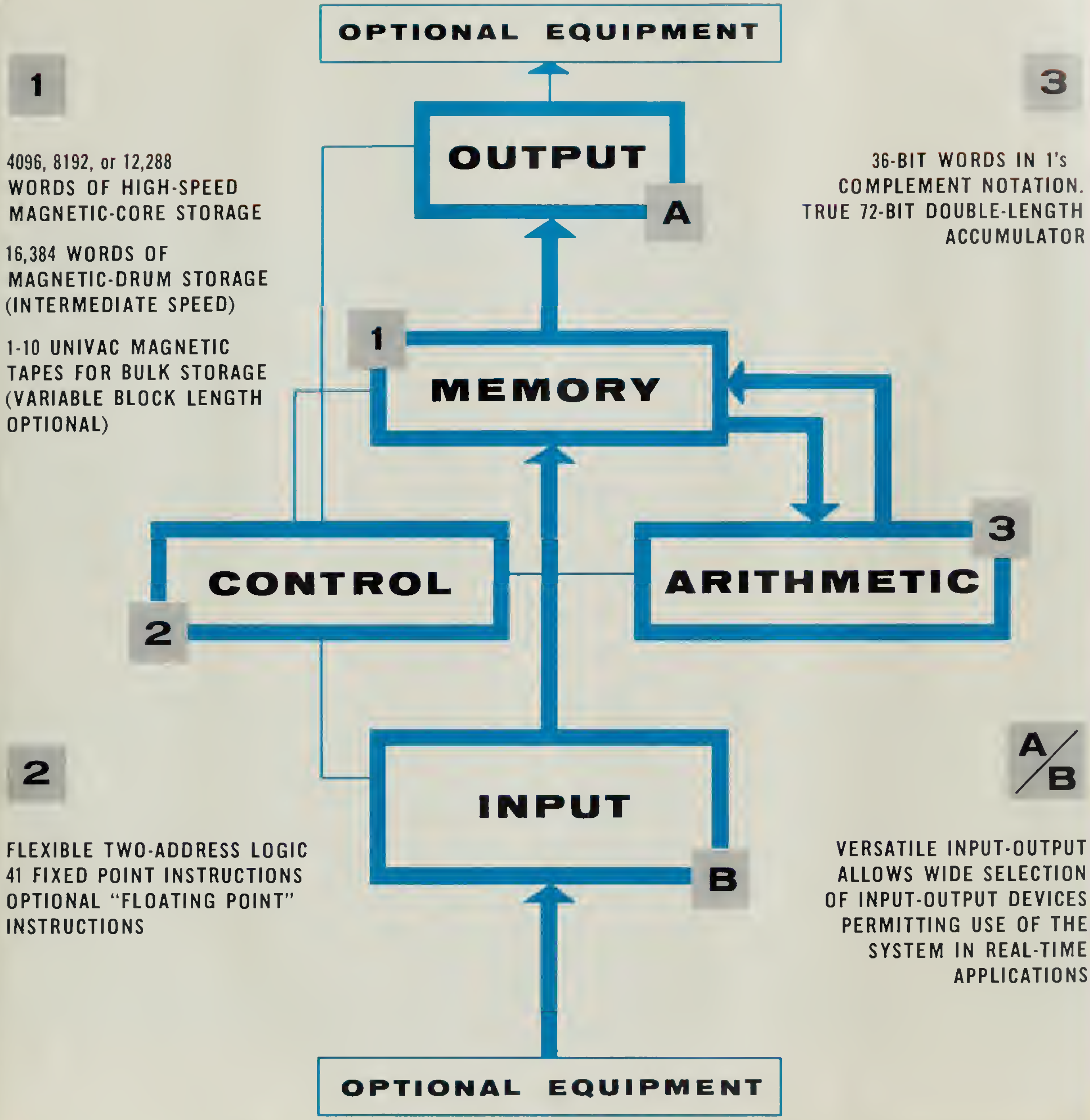
1. INPUT;
2. OUTPUT;
3. STORAGE;
4. ARITHMETICAL-LOGICAL; and
5. CONTROL

Understanding the operations in these five areas will provide a general understanding of how the computers operate.

The input devices are those used to get the data into the machines. They feed the machines the numbers and letters that constitute the primary data. These devices are very important aspects of the system as the applications of the system depend upon the availability of adequate input facilities. The input devices must be able to handle large quantities of data with great speeds. The most common input devices are:

1. Keyboards attached to the computers;
2. Magnetic tape inputs;
3. Paper tape inputs; and
4. Punched card readers.

All of these devices are widely used, but the magnetic tape is



1

4096, 8192, or 12,288
WORDS OF HIGH-SPEED
MAGNETIC-CORE STORAGE

16,384 WORDS OF
MAGNETIC-DRUM STORAGE
(INTERMEDIATE SPEED)

1-10 UNIVAC MAGNETIC
TAPES FOR BULK STORAGE
(VARIABLE BLOCK LENGTH
OPTIONAL)

2

FLEXIBLE TWO-ADDRESS LOGIC
41 FIXED POINT INSTRUCTIONS
OPTIONAL "FLOATING POINT"
INSTRUCTIONS

3

36-BIT WORDS IN 1's
COMPLEMENT NOTATION.
TRUE 72-BIT DOUBLE-LENGTH
ACCUMULATOR

A/B

VERSATILE INPUT-OUTPUT
ALLOWS WIDE SELECTION
OF INPUT-OUTPUT DEVICES
PERMITTING USE OF THE
SYSTEM IN REAL-TIME
APPLICATIONS

Fig. 4.--Diagram of Computer Operations

comp[illegible]

[illegible]

[illegible]

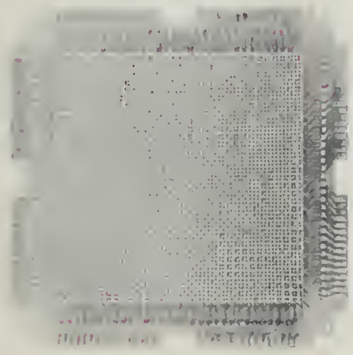
[illegible]

preferred and will probably emerge to be the standard media used due to its speed potential and its compactness. Magnetic tapes are not yet proven for adequacy for primary records, auditability and legality, and the cost of the tape is higher than the other three methods. However, advantages will accrue as the tape becomes less expensive, and the audit and legal problems are resolved. Another major advantage of the magnetic tape is that there is no limitation on the length of records that can be handled. The magnetic tape is usually made of a plastic ribbon coated with iron oxide; sometimes a metallic tape is used. The information is transposed to the magnetic tape either from perforated paper tape, punched cards, or written on the tape with a magnetic tape writer.

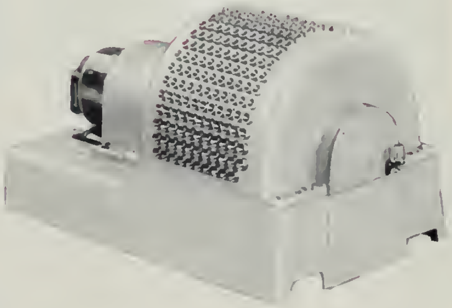
The storage devices, Figure 5, of the computer may be classified in three categories depending on the average time required to find any given piece of information stored, or the access time. The classes are fast, medium, and slow access. By fast access it is meant that the machines can give access to any given piece of information in about 500 microseconds or less. The medium access time is from six to eight milliseconds up to two or three seconds, and the slow access time ranges from several seconds to several minutes.

The fast access devices are the Electrostatic Memory System and the Magnetic Core System. The electrostatic system uses a cathode ray tube that operates by generating a beam of electrons which pass through two sets of deflecting plates. As voltage activates these plates, the beams of electrons impinge

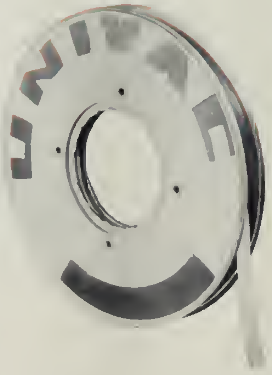
univac scientific memory



Magnetic Core Storage
4096, 8192, or 12,288
words



Magnetic Drum Storage
16,384
words



Univac Magnetic Tape Storage
1 to 10 units and variable
block length feature available

Fig. 5.--Storage Devices

MODEL ROOM

upon any desired spot on the tube. The face of the tube is divided into a checkerboard array of many small squares on which the data is read in or later selected out. The magnetic core system uses ferrite cores which are tiny doughnut shaped rings that are magnetized in a special way. Once magnetized, the conditions are remembered indefinitely or until the core's condition is changed by the writing in of new data.

In the medium access group, the magnetic drum is the most common form used for internal computer storage. The drum is a rapidly rotating cylinder continuously driven by a motor. It is made of a non-magnetic material that can be magnetized readily. On the outside of the drum there are many heads that can be read from or written into by magnetizing small spots on the drum's surface for writing into and by detecting the presence of magnetized spots for reading from the drum. Each drum can store the equivalent of the amount of data stored on 1,800 punched cards and has the average access time of 8.5 milliseconds. Magnetic drums are widely used as they are economical, reliable, require little maintenance, compact, an efficient medium of random access memory, non-volatile, and permanent memory devices. In inventory systems, large random access memories are required which has led to the development of the IBM Type 305 RAMAC, Figure 6. This storage system or file is capable of handling 5,000,000 characters on the 50 ferrous oxide coated aluminum disks that look like a huge record player, and the reading and writing is done by an arm travelling on concentric tracks on the disk until it locates

Fig. 6.-RAMAC Disk Storage

the desired track. The average access time of the RAMAC is six-tenths of a second.

The slow access storage units have a tremendously large capacity, relatively low access time, and have a very low cost per bit of information stored. Magnetic tapes are universally used on the large type EDPMs. Each single 2,400-foot reel of tape can store the information contained in 20,000 punched cards. In the Navy Supply System one reel of tape may contain all information that is now stored on 50,000 cards. The magnetic tape principle of storing information is the same as used on the magnetic drum. Reading from and writing on the tape is done by a photoelectric cell with the tape mounted on a device similar to a motion picture projector. The access time on tapes is slow, as it requires up to several minutes to locate data. The tapes are used because they are economical, reliable, compact, permanent, and there is no limit to their storage. The other types of slow access storage media are magnetic wires, photographic storage, and registers; however, none of these are used in existing equipments.

The heart of the EDPM is the Arithmetical-Logical Unit and the Control Unit. These are located in the same cabinet, which is physically quite large, some ten feet high, three feet deep, and forty feet long. This unit contains the fast access storage device, the registers for holding data being operated on, and the devices for controlling the operations. It also contains the associated hardware to accomplish the arithmetic and logical operations and to control the transfer of information among the

various units - input, output, and storage. The arithmetical unit operates on the principle of a circuit with two tubes, one conducting current while the other is shut off. Each time the electric pulse is directed to the control grids of the two tubes, their relative positions change; the tube that was on goes off, and the tube that was off goes on. This is called the "flip-flop" and is descriptive of the behavior of the tubes in the circuit. Electronic computers are controlled by the combining of a number of flip-flops, and the accuracy of control and timing is dependent upon the engineering perfection of the computer. The timing is critical as the individual pulses may be only 1/1,000,000 of a second in duration. The arithmetical section of the computer will do the basic arithmetic steps as add, subtract, multiply and divide. These are accomplished by furnishing the computer with instructions that tell the computer the address of the factors involved, the operation to be performed, and the address where the result will be stored.

In addition to the arithmetical operations, the computers have the ability to carry out logical operations that permit them to handle exceptions and special cases in a standard procedure. The computer normally goes from one successive operation to the next, but if any unconditional jump instruction tells the computer to take its next instruction from some other than the one in normal succession, the computer will make a jump into some new place in its memory for the next instruction. Thus the computer can recognize several possibilities, and then use that information to select the appropriate succeeding operations. This ability has given the

computers the nicknames as " Giant Brain" and "Electronic Brain," but by no stretch of the imagination can it think or be considered to be a "brain." Computers are not smart, as everything they accomplish must be furnished to them with many detailed instructions.

Computer control is divided into two different parts, the external control and the internal control. The external control is the operation of the computer using the computer console, Figure 7. The operator can start and stop the computer, perform any operation, control any input and output device, read any register or counter, and read in or read out of any memory location. The machine will signal the operator if it recognizes any error or if the computer is malfunctioning. All operations are usually programmed into the computer so the operator usually only has to stop or start the computer. The control console gives the operator a comulete picture of what is going on inside the machine and gives him control over the functions of the machine.

The internal control functions of the computer are the controls that provide maintenance control, marginal checking, and checking accuracy either by program or by built-in checking facilities. The computer control unit tells the operator of the failure of some component and the location of the component. The marginal checking is done by a built-in maintenance circuit that checks the resistors, tubes, circuit components and other parts to assure that they are operating within their prescribed voltage ranges and, if not, these elements can be replaced on a

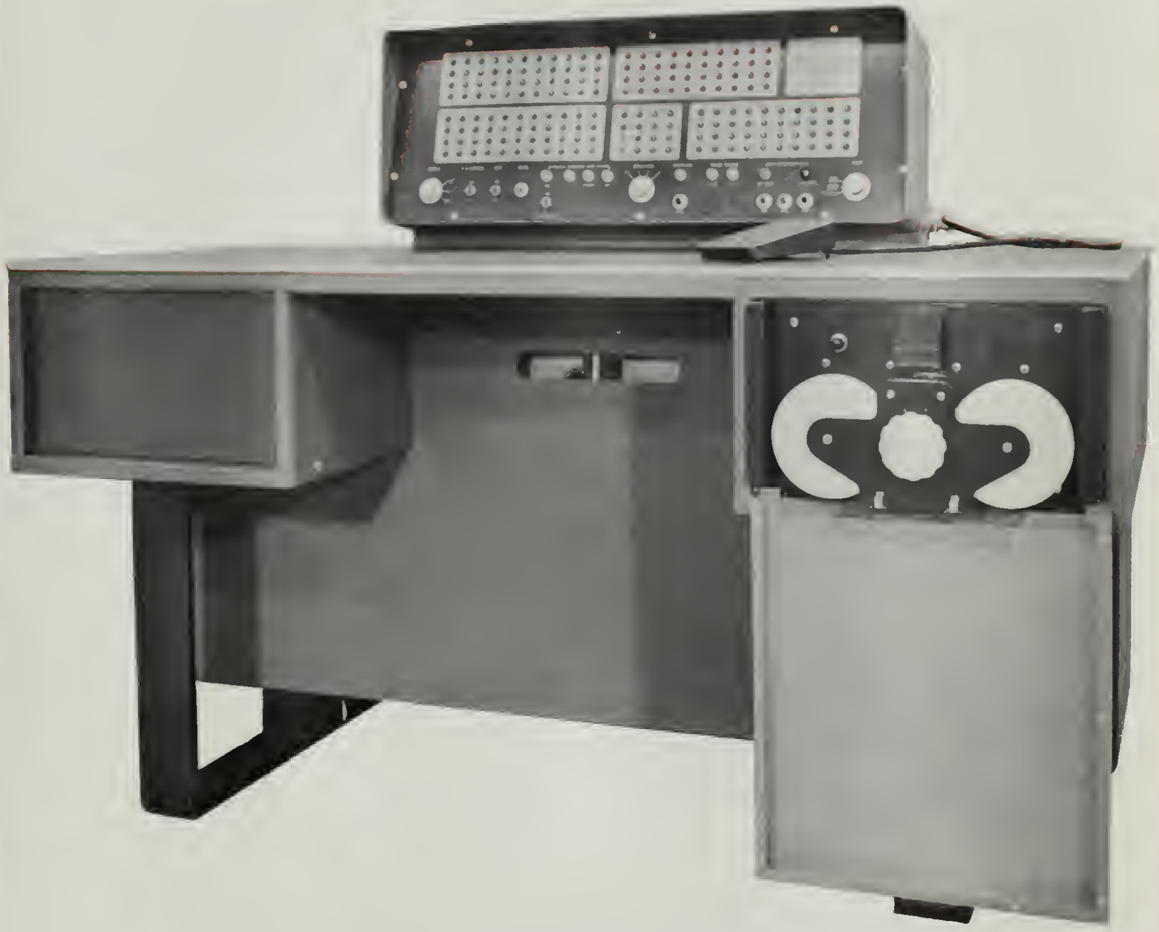


Fig. 7.-Computer Control Console

routine maintenance basis, and the computer will never actually fail.

Computers produce results with great speeds and are capable of making numerous errors in a few seconds if something goes wrong. The problems with these errors is the realization that the trouble exists, localizing the trouble, and taking corrective action. One method of checking is the programmed checking or the programming of information into the computer so that it will perform the same operation in two different ways thereby allowing for a check of the results. Another method of internal checking is the built-in feature that includes duplicate arithmetical and logical sections with automatic comparison circuits. With these two methods there is the question of which is the more efficient, the additional programming or the additional 20 to 25% in the cost of the computer with the built-in checking facility. The programmed checking requires more lengthy programming, which may be very costly in man years, so the built-in checking procedure may well be an excellent investment. Another feature of some computers is the error checking and self correction where the computer recognizes the error, returns to the last block of data and repeats the operation. If the error is calculated correctly on the repeat operation, the computer continues with its operations. This feature is very important as many isolated errors are corrected internally with no machine stoppage or wasted effort in searching for the trouble.

The output devices, Figures 8 and 9, of the computers

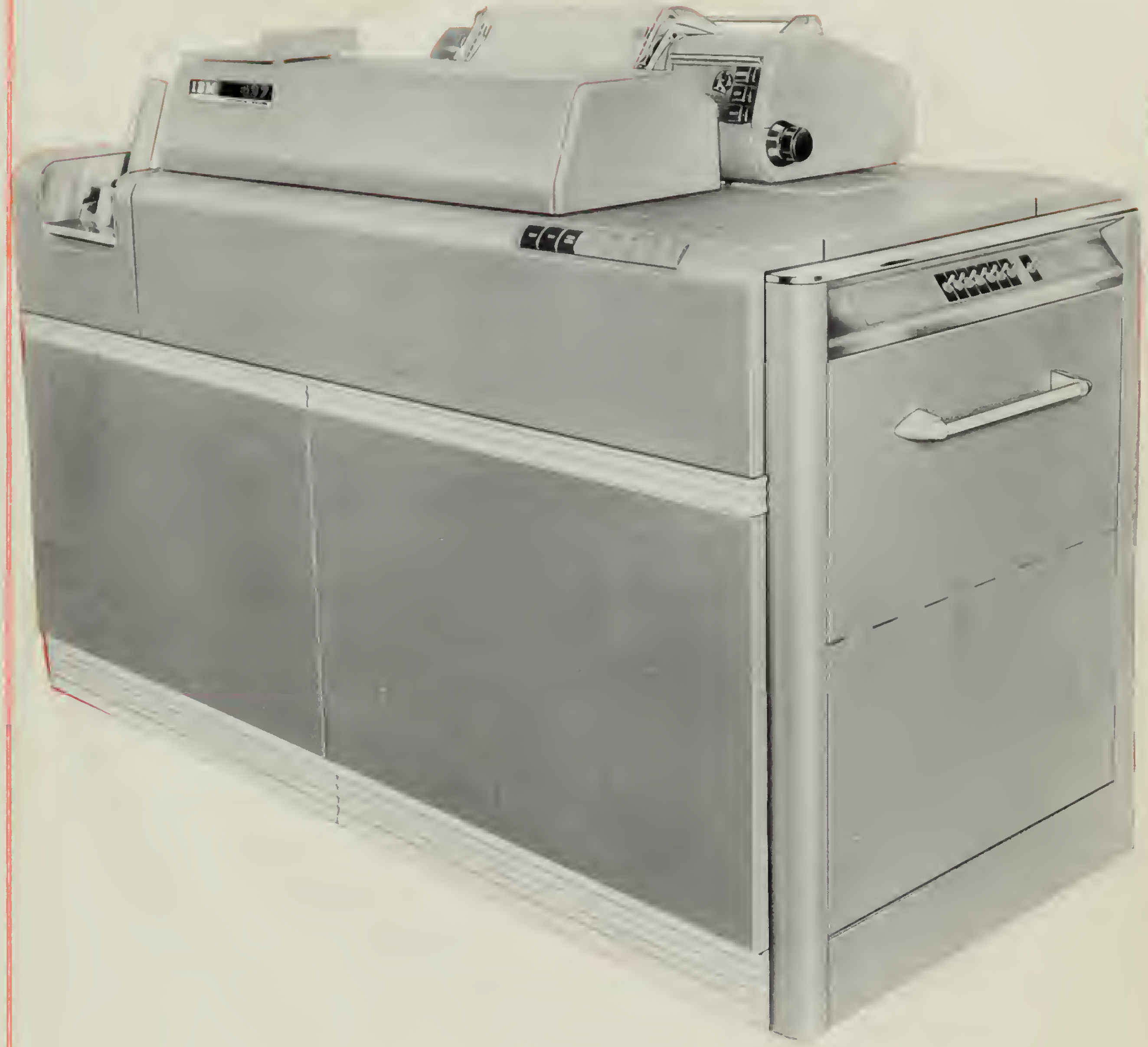


Fig. 8.--Output Device--Printer

Fig. 9.--Output Device--Magnetic Tape

are limited as there are really only two used at present, the high speed printers and the punched cards. The printers are similiar to the electrical accounting machine printers with type wheels and the ability to handle 120 to 130 characters per line. The amazing feature of these printers is their speed. Speeds of 600 lines per minute are common, and there are machines that print 900 to 1,000 lines per minute routinely. The punched card output devices punch cards instead of printing. This may be beneficial as there are many uses of the punched cards in combination punched-card and printed data systems in business.

There is development work being done on the output devices, one of which is the work of Consolidated-Vultee Aircraft Corporation of San Diego, California. This company has developed a data output system using the high speed of the cathode ray. This ray will display 10,000 to 20,000 characters per second or about 12,000 lines per minute. This method is limited as the data is on the face of the cathode ray tube rather than being printed on paper. The present recording media is a high speed camera photographing the face of the cathode ray tube. Efforts are being made to adapt this to a chemical printing process.

Another type of output device that has been developed is the electrostatic printer capable of printing 5,000 words per minute. This device impresses characters, in the form of electrostatic charges, on a special, low cost paper which is passed through a dry ink bath where the particles adhere to the

charged areas. The paper then passes over a hot plate where the ink is permanently fixed.

The entire success of the EDPM installation depends upon the adequacy of machine programming. The machine will do nothing without instructions. Programming is a very expensive part of the EDPM installation as it translates the data processing problems into machine language. The machine program consists of three parts:

1. A set of machine instructions;

2. A detailed flow chart depicting the sequence of the operations in the program; and

3. A set of instructions to the machine operator.

There are fixed and variable programs for the computers that may be internally or externally stored. The fixed programs are usually found in special purpose machines as airline reservations and inventory control, while the variable program computers are the general purpose type and will follow any sequence of instructions. The externally programmed computers use a wire plugboard to set up short routine calculations, or they may receive their instructions from punched cards, using a single card for each instruction. The internally programmed machines are the most commonly used as they receive their instructions in coded form in successive memory positions and execute the operations successively as coded.

Management and the Electronic Data Processing Machines

The electronic data processing machine's decision-making ability is very limited as the machine arrives at its decisions by comparisons of alphanumeric quantities, and the only possibilities are "greater than," "equal to," or "less than." It acts on the basis of its predetermined sequence of processing steps where the possible sequences depend solely upon the condition existing in the comparison. The criterion for each comparison must be set up by people, converted into machine language, and after this is done, the EDPM will make the decision and follow the proper sequence of steps. In addition to its limited decision-making capabilities, the EDPM has no ability to exercise judgment. In the development of EDPM programs, if management can take the quantative criteria of choices in decision making, the EDPM may exercise the decision-making function now being made at the clerical level. " The potentialities of EDPMs as decision-making tools are enormous: the difficulties of achievement, equally so."[1]

In the study of EDPM the terms " problem definition" and " problem specification" are used and should be understood. "Problem definition" involves the existence of a problem or in a broader sense any major business function. The first element of problem definition is to learn everything about the problem.

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[1] U.S., Navy Department, Bureau of Supplies and Accounts, *Introduction to Electronic Data Processing Machine Applications. NAVSANDA Publication 284*, 1955.

Limiting the study to the what is only a part of the problem definition, but the why, where, when, and how must be investigated, charted by flow charts, and written up in detail. The second element of problem definition consists of the development of alternate methods of handling functions as a whole. The third phase that follows is the evaluation of the results of the first two steps and the decision on a future course of action. Problem definition with its three phases is the basis necessary for arriving at the decision for or against conversion to an EDPM system.

"Problem specification" is the taking of a broad outline of what is to be done with supporting data and information, and converting this into a detailed outline as to how the job is to be done. Problem specification results in detailed procedures in ordinary language and flow charts, for the performance of necessary operations to accomplish a data processing function. In EDP systems, the factors of problem specification include:

1. Input specifications;
2. Processing specifications;
3. Output specifications;
4. Standard or library specifications; and
5. Specifications for exceptions or errors.

Justifying an EDPM system for the business man and for the military man involves different but somewhat similar considerations. The business man must always keep in mind the Profit and Loss Statement while the military man is interested in military efficiency, then the amount of dollars he can save.

The dollars saved for the military man is similar to the profit savings for the business man, but the dollar value of defense cannot be measured. Even with the differences in their objectives their justification methods and studies are similar.

In the business world, the members of top management generally decide that an EDPM system may be useful, and a committee is then appointed to study the problem. The committee members are carefully selected and usually include a vice-president, paperwork management personnel, accounting personnel, and administrative personnel. The committee studies the feasibility for the system and presents the results to top management for decision. Sometimes even the Board of Directors of a company make the decision for the EDPM conversion. Some companies do not use an internal committee for these studies, but call in management consultants, who make the complete feasibility study and present their findings to management for decision.

In the military, there is often a committee established consisting of top management officials at an activity, who study the feasibility for the EDPM. However, in the military, the activity must receive permission and approval from the parent bureau, from the service management office, and from the executive officer of the service secretary prior to conversion to EDPM. The allotment of funds to finance the installation is another major consideration for the military man to study. His justification may receive support from all offices, but funds may not be available to finance the conversion, and he must

[illegible]

[illegible]

[illegible]

wait until funds become available.

In the Navy Supply System there are four main considerations upon which an affirmative answer for an EDPM conversion may be based:

1. Savings in clerical labor, space, equipment, and other expenses financed by the Bureau of Supplies and Accounts appropriations;

2. Savings in expenses financed by other appropriations;

3. More effective supply operations from better and more advanced processing techniques; and

4. Mobilization possibilities.

Any one of these four may be sufficient to justify an installation, but in any installation the other three advantages probably will accrue.

Conversion to EDPM is not an overnight affair, and there are many detailed studies that must be undertaken prior to arriving at the EDPM conversion decision. Seven essential steps in studying and designing an EDPM conversion in business are:

1. A thorough analysis of the present system must be made;

2. An outline of realistic objectives for the system must be made by working with top management and other levels directly or indirectly concerned with data processing;

3. Planning must be done creatively and with imagination;

4. A detailed machine research program must be undertaken with the committee doing the research as the ultimate decision on the equipment to be chosen remains with the committee;

5. A lay-out of the specific steps by which the system will take shape must be prepared;

6. A complete cost analysis must be prepared. This will probably be the item that will bear the most weight in the EDPM decision; and

7. A detailed schedule for converting to the new program and for the installation of the machines must be made.

A timetable for the study and conversion to an EDPM system should be prepared, and on the basis of past experience in business, the total study will vary from twelve to thirty months with each step requiring the time set forth in the following table:

TABLE 3[a]

TIMES REQUIRED FOR FEASIBILITY STUDIES

	Months
Feasibility Study	1 to 2
Review of present operations	2 to 6
Development of new data flow lines	2 to 4
Research on equipment	1 to 3
Preparation of a recommended program	3 to 8
Testing of system and equipment	1 to 2
Approval and indoctrination period	1 to 3
Installation and training period	1 to 2
Total estimated time	12 to 30

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[a] American Management Association. Establishing an Integrated Data Processing System (New York: American Management Association, Inc., 1956), p.35

In the Navy Supply System the detailed steps outlined above for business may not consume the estimated times as the Bureau of Supplies and Accounts has established a branch, (Code S16) of the Inventory Control Division, for the study of EDP systems. This division develops and monitors the Bureau of Supplies and Accounts data processing policies and procedures to assure expeditious, complete and appropriate utilization of equipments and techniques. It provides assistance to the activities of the Bureau of Supplies and Accounts in making feasibility studies, investigating equipments, providing of financial and budgeting data relative to EDP costs. It maintains a technical information service and participates in the on-site examinations and analysis of procedures employed at activities of the Bureau of Supplies and Accounts. This office is staffed by highly technical personnel, skilled and experienced in the Navy Supply System procedures and the EDPM operations.

As the activities of the Navy Supply System are similar and have similar problems, it is not necessary that each activity independently justify an EDPM installation. Pilot runs of the equipments are made, and after a successful conversion at one activity, other activities can prototype the installation and circumvent much of the work and cost of EDPM justification and conversion.

Electronic Data Processing Personnel

One of the major problems facing business as well as the Navy is the recruitment, training, and retention of

personnel to operate the EDPM. There is no labor market for EDP personnel; it is all demand and no supply. This scarcity will probably continue for a number of years even though steps are being taken by the producers of the machines and some colleges to train more personnel.

All EDP personnel do not require the same training, characteristics, or background, but there are several groups of personnel that will be utilized from the beginning of the EDP study until the time the installation is made and operating smoothly. These groups are:

1. The analysis group;

2. The problem specification group which may or may not be the same as the analysis group;

3. The programmers; and

4. The machine operators.

The analysis group personnel are those who will set up a time schedule for the EDP applications study, acquire a basic knowledge of EDP methods and characteristics, study the existing systems and procedures and evaluate them for EDP practicability, supervise the detail problem specification and programming, and develop the long range program for an effective EDP system. The members of this group should be responsible to a high level of management directly and should work on this problem on a full-time basis. The qualifications for these personnel are that they should know system objectives, punch card procedures and techniques; have some experience in procedures, methods, statistical analysis; and an acquaintance with EDP methods and

potentialities.

The members of the analysis group usually will be obtained from within the organization. Those requiring EPD method training should receive a minimum of one week's training and a few should be trained for at least a month on programming of a specific equipment. The other members of this group should avail themselves to the one or two weeks' courses offered by the various manufacturers, each member studying a different equipment if possible.

After the analysis group has completed the study, and an EDPM installation is decided upon, a problem specification group should be organized. This group will not be large as its size will depend upon the job to be done. One or two of the personnel in this group should be those who were in the analysis group, and who had at least one month's training on the EDPM. They should know punched card procedures and should have a knowledge of the objectives and the procedures of the activity.

The third group of personnel required are the programmers, who probably will be recruited from within the activity if electric accounting machines are used. The number of programmers will vary as more programmers are required during the conversion and the first year or two of operation. The requirements for the programmers are many, but one important qualification is a logical mind. They should know the activity and its operations, and being mathematically inclined is helpful. The programmers should be selected soon after the decision for the EDPM installation is made. They should be

trained intensively by the company furnishing the machine for a period of two or three months. After training, about six to twelve months of operating experience are required to gain proficiency in programming.

The final group of EDP personnel is the operating group. This group includes the card punch operators, the tape recording machine operators, and the operators of the computer. This is the group of personnel that is most troublesome for business and for the Navy. Their work, especially card punch and tape recording personnel, is usually very boring and there is an exceptionally high turn-over rate in their ranks. These people require little training, whereas the computer operators require a considerable amount of training. To aid in the selection of the operating personnel, the larger computer manufacturers have devised aptitude tests for EDP personnel. International Business Machines uses the test, "Aptitude Test for EDPM Programmers," and also has other aptitude tests for operators and card punch personnel. These tests have proven very satisfactory.

The operations of an EDPM installation require little genius once the programs are designed, established, and in operation. Nearly anyone can go through a group of fixed motions, and with good supervision can attain the desired results. An unskilled high school graduate can be trained in a short time to handle most data processing jobs. Companies studying data processing personnel problems have found that the older workers, male or female, are more stable and more productive in this type work than the younger workers.

There is a great human relations problem in handling a group of EDPM operators due to the nature of their work and the demand for their services. Their pay cannot be too high as their work is mostly routine, and as they work in close quarters on integrated processes, they must be able to work with other people harmoniously. They also operate extremely costly machines and work on highly important data. Companies must have high employee standards and provide an adequate selection and a recruiting program that will assure competent personnel necessary for a successful EDPM program.

An EDPM conversion sometimes generates a fear in many employees that the EDPM is a threat to the security of their jobs. Labor Union leaders of office worker groups have made statements to the effect that office automation will cause the loss of millions of clerical jobs and will even create a depression and unemployment situation that will dwarf the depression of the early thirties. These facts are unfounded, based on the experiences of companies converting to EDPM. Among 300 companies, there have been fewer than twelve employees fired due to EDPM. Excess clerical personnel are given the opportunity to transfer to some other clerical job or to some other type of work. This is being done throughout the business world, and a majority of the personnel transferring are going to jobs where they are being upgraded in both position and pay.

It is the duty of management to bring the clerical personnel into the EDPM picture at the beginning of the operation so that their cooperation may be obtained. There should be

factual presentations on the EDPM installation, and each worker should be told exactly what is in store for him when the EDPM program actually reaches the office. Management has experienced difficulty with supervisory and lower management personnel who fear that reorganization for the EDP will cause them to lose their status, rank, and seniority. An EDP system must be founded on a trained and competent supervisory force that has been developed from the supervisory force within the company.

CHAPTER III

EDP APPLICATIONS IN THE NAVY SUPPLY SYSTEM

General Applications

The effectiveness of the Navy Supply System has been greatly increased during the past ten years, but with the innovation of stock status reporting, financial inventory reporting, commodity management at the Supply Demand Control point, centralized storage control, centralized traffic control, and many other advances, there is still a wide area for improvement. Supply activities still operate as self-contained units to a certain extent, with their own records and reports to the bureaus. The advent of Electronic Data Processing opens an enormous field for supply data on a system-wide basis, system action and stock reports, and system management analysis. Electric accounting machines provided for the initial breakthrough on these systems, but only the surface has been scratched. EDP offers the opportunity for complete data integration and for data communication. The Bureau of Supplies and Accounts has established the following objectives for its data processing program:

1. To establish an Integrated Data Processing System providing for all aspects of Supply and Related Operations using:
    Electronic Accounting Machines
    Data Processing Machines
    Data Transmission Equipment

2. To provide more responsive reporting for predicting requirements.
3. To provide more current and complete failure and usage data as a basis for predicting requirements.
4. To provide more timely and accurate material availability data.
5. To improve requisitioning procedures.
6. To accelerate material movement to the Fleet and Supporting Units.
7. To study future needs for System and Equipment Development and Modification.
8. To provide optimum support at Industrial Type Shore Activities.[1]

In order to achieve these objectives, the Navy Supply System has formulated the following plans for the use of the EDP equipment:

1. Incorporation of criteria to permit automatic preparation of output data--operating on the principle of management by exception.
2. Incorporation of additional criteria in the computation of system material requirements.
3. The reduction of processing time for computing supply requirements, as well as the reduction in processing time for preparation of management reports.
4. Monetary savings through reduction of personnel (by attrition) and existing equipments, and/or intangible savings through improved supply support.
5. Integration of the inventory and financial control aspects of financial management.
6. Testing and evaluation of supply research projects.
7. Integration of data submitted by transmission facilities with data processed by the Automatic Data Processing Equipments.
8. Computation of spare parts for ships, based upon, and in ratio to the number of uses for each individual spare part.
9. Eliminate reference work files by consolidation and conversion to magnetic tapes, disc storage, or to other storage media compatible with ADP equipments.
10. Preparation of management reports heretofore impossible due to (1) time required to produce with conventional equipment, or (2) incorporation of complex mathematical formulae beyond the capacity of conventional equipments.
11. Obtain capacity for mobilization expansion.

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[1] U.S., Navy Department, Bureau of Supplies and Accounts, BUSANDA Letter, Code 8.16.8, 13 Feb. 1958.

12. Stratify inventories, as well as to compute budgetary requirements.
13. Improvement in supply effectiveness to operating forces ashore and afloat; the integration of source information through high speed transmission, with in-line data processing and simultaneous updating of basic records whenever possible, to result in output action data for appropriate distribution via rapid transmission systems.
14. Automatic accumulation of supply data during in-line processing to facilitate preparation and submissions of management reports.[2]

The installations now in operation and planned for the Naval Supply Activities may be divided into the following categories:

1. Those applications installed or planned for the major supply centers;

2. Those applications installed or planned for the supply depots, large supply departments of shipyards, air stations and other activities with large inventories and a high volume of transactions; and

3. Those applications at the Supply Demand Control Points.

The activities with equipment installed, on order, or planned are listed in Table 4.

The large Supply Centers at Norfolk, Virginia, and Oakland, California, have made studies for EDPM installations to be used for inventory control. Neither of these activities have reached a final decision as to the type or make of equipment that will be best suited for their purpose. The studies so far have not been conclusive, but either a medium or large type

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[2] *Ibid.*

TABLE 4

ELECTRONIC DATA PROCESSING EQUIPMENT INSTALLED, ON ORDER, OR SCHEDULED FOR INSTALLATION AT NAVY SUPPLY AND FINANCIAL ACTIVITIES[a]

Activity Name	Location	Type of Equipment	Date Installed
Installed Equipment			
Supply Demand Control Points:			
Aviation Supply Office	Philadelphia, Pa.	IBM 702	May 1955
Aviation Supply Office	Philadelphia, Pa.	C.O. 650[b]	April 1956
Electronics Supply Office	Great Lakes, Ill.	C.O. 650	May 1956
Ordnance Supply Office	Mechanicsburg, Pa.	C.O. 650	July 1956
Ships' Parts Control Center	Mechanicsburg, Pa.	IBM 705	August 1956
Aviation Supply Office	Philadelphia, Pa.	IBM 705	September 1957
General Stores Supply Office	Philadelphia, Pa.	C.O. 650	September 1957
Electronics Supply Office	Great Lakes, Ill.	C.O. 650	February 1958
Supply Support Activities:			
Naval Supply Center	Oakland, Calif.	C.O. 650	February 1957
Naval Supply Depot	San Diego, Calif.	C.O. 650	October 1957
Naval Supply Depot	Newport, R.I.	IBM 305 RAMAC	December 1957
Naval Shipyard	Charleston, S.C.	IBM 305 RAMAC	February 1958
Equipment on Order			
Supply Demand Control Points:			
Electronics Supply Office	Great Lakes, Ill.	UNIVAC II	April 1958
Navy Ship's Store Office	Brooklyn, N.Y.	UNIVAC FILE COMPUTER I	November 1958
Yards and Docks Supply Office	Port Hueneme, Calif.	IBM 705	November 1958
Submarine Supply Office	Philadelphia, Pa.	DATATRON 205	December 1958
Supply Activities:			
Naval Supply Depot	Bayonne, N.J.	C.O. 650	May 1958

TABLE 4-Continued

Activity Name	Location	Type of Equipment	Date Installed
Equipment Planned for Installation			
Supply Demand Control Points:			
Ordnance Supply Office	Mechanicsburg, Pa	Medium	March 1959
Aviation Supply Office	Philadelphia, Pa.	Large	March 1959
Supply Support Activities:			
Naval Supply Center	Oakland, Calif.	Medium or Large	March 1959
Naval Supply Center	Norfolk, Va.	Medium or Large	March 1959
Navy Finance Center	Cleveland, Ohio	Large	March 1959

[a] U. S., Navy Department, Bureau of Supplies and Accounts Letter S16.8, February 13, 1958.

[b] Card Operated IBM 650

installation will be made at both of these activities in early 1959. The EDPM history and future planning for the Naval Supply Center, Norfolk, are similar to those expected for the Naval Supply Center, Oakland, it is not necessary to discuss large supply center applications further at this time.

At the Supply Depots and the large Supply Departments at major air stations and shipyards, the EDPM installations are being utilized to facilitate faster data processing and methods of obtaining information. The IBM RAMAC has been installed at the Naval Supply Depot, Newport, Rhode Island, and at the Naval Shipyard, Charleston, South Carolina, for inventory control purposes. The installations at the other Supply Depots listed in Table 4 are used primarily for accounting and fiscal procedures with some stock record keeping.

The Supply Demand Control Points offer the greatest potential direct savings through conversion to EDPM. From Table 4 above, it can be seen that most of the activities have already installed EDPM, and other activities have equipments on order or are definitely scheduled for conversion during 1958 or 1959. In general the advantages that accrue to the Navy through the use of the EDPM at the Supply Demand Control Points are:

1. Reduction of the processing time cycle of the Quarterly Stock Status Reports, which enables the reduction of the quantity of material now necessary in the Supply Demand Control Point system, the reduction in the number of interim requisitions through faster supply control action, and more frequent cycles of supply review of active and expensive items.

2. Supply Control decisions are programmed in the equipment, which means that a major portion of supply requirements, redistribution, and cancellation actions are performed automatically and much faster providing for more uniformity in decision and a reduction in clerical time.

3. The EDPM provides a tool for "Management by Exception," as all items are analyzed but only those requiring further study are printed.

4. The complete supply story is provided.

5. By the use of memory storage, many feeder reports are eliminated.

6. The results accruing from the preceding five advantages lead to savings in clerical personnel and electric accounting machine rental costs.

The Supply Demand Control Point activities have similar EDPM problems as they manage large inventories which must be kept up-to-date, must be reported upon, must be reduced or increased as required by the demand, and must have system procedures available to permit effective and rapid distribution of the stock. At the Aviation Supply Office, Philadelphia, Pennsylvania, stock actions in one quarter totalled 458,000, which is twice the volume of any other Supply Demand Control Point. The Supply Demand Control Points do not carry physical inventories, but they manage inventories carried throughout the supply system. The EDPM installations at the Supply Demand Control Points are usually the large type and are quite expensive. Therefore, the feasibility studies must be thorough, the

programming must be completed, and the personnel adequately trained prior to the installation. The Ships' Parts Control Center will be discussed in more detail later in this paper.

EDPM at the Naval Supply Center, Norfolk, Virginia

The Naval Supply Center, Norfolk, Virginia, was chosen for discussion as the extensive IBM 305 RAMAC test was made there in 1956-1957. Neither of the large centers have EDPM applied directly to supply and inventory problems, but the Naval Supply Center, Oakland, has installed a card operated IBM 650 which is used primarily for payroll and accounting applications. The Naval Supply Center, Norfolk, has no EDPM at this time, but a large or medium installation is planned for early 1959.

The Naval Supply Center, Norfolk, is the major supply activity on the East Coast and handles the following types of material:

1. Aviation supplies;
2. General supplies;
3. Fuel;
4. Ships' Parts;
5. Special Weapons;
6. Yards and Docks supplies; and
7. Provisions.

The Center also has a Purchase Division and an Annex at Cheatham, Virginia.

The Naval Supply Center has 5,669 civilian employees of which 1,912 are graded. There are 559,000 material items carried at the Center with the value of about $569,000,000. Approximately 6,725 expenditure documents are processed daily. In addition to the Supply Center's business, accounting for 40 smaller activities and 10,000 civilian pay accounts are maintained.

The mission of the Naval Supply Center includes the stocking of the various types of materials for activities listed above and the rendering of supply service to the fleet and shore activities. With the large volume of business required to perform its mission, the possibilities of an EDPM conversion was explored, and a committee was established in November, 1954, to make the study for EDPM feasibility and applications. By January, 1955, the committee was operating and held meetings with Remington-Rand representatives. By April, 1955, Remington-Rand presented the Naval Supply Center with a proposal for a UNIVAC for immediate conversion to EDP and extensive savings were indicated immediately with greater savings to accrue in the future.

In November, 1955, the Bureau of Supplies and Accounts made arrangements for an installation of an IBM 305 RAMAC (Random Access Method of Accounting Control) to be on a test basis to determine if this EDP system of in-line processing and random-access memory would actually handle Navy Inventory Control and the relative financial procedures under simulated

operating conditions; to compare and evaluate in-line processing coupled with management by exception techniques; and to determine the adaptability of this equipment to the methods and procedures of the supply system.

In August, 1956, the RAMAC was installed, and the tests were begun. The tests were specifically to determine:

1. The possibility of maintaining stock and financial inventory control records on an EDP system through in-line processing of transactions against these records;

2. The degree of effectiveness of the decision-making capabilities of the computers;

3. The feasibility of a punched-card document;

4. The capabilities of the machine for creating data for passing action and stock status reporting;

5. The economic feasibility of the equipment applications; and

6. The possibilities of applications to other functions.

During the test of the equipment, thirty-seven programs were developed, "debugged," and tested. Many of these programs were run in detail. The type of programs tested included operations of receipt, expenditure, cash sales, transfers and surveys, financial accounting, the per diem payroll, and the per annum payroll. All of the applications tested were successfully applied to the equipment. The access time required for any desired record was 400 to 500 milliseconds. The integrity of the information stored on the Disc Memory was excellent

throughout the test. The few failures of the equipment were due to operator or program fault, and in a few instances the RAMAC failed to pick up the proper address from the address register.

The tests proved that the RAMAC could handle the applications tested, and in addition, it was concluded that the RAMAC is highly desirable for Naval Stocking Activities having 30,000 to 40,000 active stock items and a daily transaction volume of 2,500 to 4,000. The test of the RAMAC was completed in June, 1957, and the equipment was removed. The machine used was a prototype model, and its use enabled the International Business Machines Corporation to improve the production model.

The tests proved valuable to the Navy Supply System, as shortly after the tests were completed plans were made to install the RAMAC at a supply depot and a major supply activity.

The Naval Supply Center, Norfolk, is still operating with the electric machine accounting system and studying the EDPM application to be made in April, 1959. The problems being encountered are:

1. What type of equipment should be selected. This question has not been solved except that the equipment will be either the large or medium type;

2. Should the equipment be rented or purchased; and

3. Should the installation be delayed awaiting equipment and application improvement. This question has been solved as it is expected that there will be no delay beyond

the April, 1959, date. A year's planning and programming can be accomplished prior to the installation.

When the EDPM conversion is made, it is anticipated that an Electronic Data Processing Control Department will be added to the Naval Supply Center organization. This department will handle all EDPM applications, make EDPM studies for further applications, and provide EDPM service throughout the Center on a common service basis.

The EDPM conversion at the Naval Supply Center is justified as it will eliminate lag time in data processing and will keep the stock control records up-to-date. In personnel savings, it is estimated that of the 737 personnel now in Stock Control, Issue Control, Machine Records, and the Fiscal Department, only 190 will be required to perform the functions with the EDPM. The dollar savings are estimated to be about $188,715 per month, the EDPM and electric accounting machine rental will be increased $7,248 per month, resulting in a net savings of $181,467 per month. The EDPM application would reduce the present issue cycle time from three days to two hours. This saving cannot be measured in dollars but will definitely add to the overall effectiveness of the Navy.

EDPM at the Naval Supply Depot, Newport, Rhode Island

The Naval Supply Depot, Newport, Rhode Island, was the site of the installation of the first IBM 305 RAMAC, Figure 10, for stock control and stock record keeping at a Naval Supply Activity. This depot carries an inventory of about 85,000

Printed Output

This versatile, new serial printer—with tape-controlled carriage—prepares reports at speeds up to 80 lines per minute, depending on the number of printing positions per line.

Card Output

This unit punches output data from 305 RAMAC into IBM cards, in any desired format, at speeds up to 100 cards per minute. Punching and printing can occur at the same time.

Processing

Within this section are magnetic cores, electronic circuitry and a magnetic drum to store programs, rearrange information and perform arithmetical and logical processing of data. A wired control panel contributes to logical decision making, as well as ease of programming.

Disk Storage

Any record stored here can be located directly, at random, without searching through unwanted information. Capacity is 5,000,000 alphamerical characters, stored as magnetic spots on the 50 rotating metal disks, visible through the protective glass cover.

Card Input

This unit transfers data from punched cards into 305 RAMAC at speeds up to 125 cards per minute. Card reading can occur simultaneously with other programmed operations. Several transactions can be recorded in one card to accelerate data input.

Interrogation and Supervision

From this console, by means of the transmittal keyboard, memory can be interrogated for specific facts—at any time. Answers are automatically typed by the receiving typewriter, mounted on the console. The various console indicator lights and switches aid in monitoring operations.

Fig. 10.-IBM 305 RAMAC

IBM

305

RAMAC

[illegible]

IBM

[illegible]

items, but 75% of their issues are made from 26,000 items. The primary mission of the Depot is to supply ships and activities in the Newport area, and 80% of the Depot's business is fleet support. In 1957, the monthly workload averaged 68,000 line items processed, 61,260 issues and 6,787 receipts.

In January, 1957, a study of the Supply Depot was begun in order to determine the feasibility of an EDPM conversion. The study was directed toward the improvement of support and the savings of funds. The studies showed that the functions of stock, issue, receipt, and financial inventory control could be adapted to the EDPM. In this study, it was concluded that the fast moving 26,000 items could be mechanized. The estimated savings in personnel costs were $146,000 per year, and a material (forms, etc.) savings of $13,000 per year would be realized. The additional costs for the RAMAC installation would be $26,000 per year, making an overall net savings of $107,000 estimated.

After the studies were completed, and the decision to install the RAMAC was made, personnel from within the Depot were selected and trained by means of classroom work, outside studies, and visits to other installations having an EDPM. There was no electric accounting machine operation at the Naval Supply Depot, Newport, so none of the personnel chosen had been engaged in mechanized operations at the Depot. This differs from most EDPM installations where personnel are usually chosen from the electric accounting machine section to work on the EDPM. It was relatively inexpensive to modify the space for the

installation as only $6,500 was required of which $3,200 was expended for air conditioning.

The RAMAC was installed at the Naval Supply Depot in December, 1957, and the first phase of the conversion to EDPM was completed by mid-February, 1958. This phase was the storage of 23,000 items on the RAMAC representing 85% of the fast-moving items. The remaining 60,000 non-fast-moving items were transcribed to Electronic Accounting Machine Cards the same size and format used in establishing the stock status balance cards for the EDPM. If one of these slow-moving items is requested, the RAMAC returns the card as not in memory, and the card is processed by stock control and returned to the RAMAC, and the item is then processed as if it were in memory. The machine punches a new card updating the balances and preparing the cards needed for the picking ticket and for the invoice. This operation requires six seconds of the machine's time.

In the processing of regular items in memory, the RAMAC system has enabled the Depot to have answers to some 150 questions within fifteen minutes after the arrival of the invoice in the Issue Control Section. Most of this time is spent in the verification of the financial data by personnel and key punching a card. Some of the questions answered are:

1. Is the item available in stock?

2. Is the request being processed on a replenishable or non-replenishable demand, a released obligation, a receipt from purchase or from other Supply Officers?

3. Is ledger posting necessary?

4. Is a substitute available?

5. Is reorder of the item for depot stock necessary?

The RAMAC also updates all quantative item records and financial ledgers. In the total time of two hours, work formerly requiring thirty hours is accomplished.

In order to align the physical issuing of the material with the increased speed of paperwork processing, the 26,000 fast-moving items were analyzed by the RAMAC and were rewarehoused in the order of item popularity based on the number of issues. As locator data is in the RAMAC and reproduced on the picking ticket, the matter of stock number, class, etc., was not an important consideration in the rewarehousing. After the rewarehousing was completed, the improvement of the whole issue operation was undertaken. In the new issuing system, faster action is achieved by having the RAMAC produce two IBM card picking tickets, which are received in the warehouse in locator sequence and distributed to the warehousemen who begin the issuing process immediately. The issue time has been cut from eight hours to one hour by the use of this system. The delivery system was also improved by the use of one carton for each activity or ship, and all items picked for each activity are boxed on arrival at the end of the conveyor where the warehousemen place the items after picking them from the bins. The containers are delivered three times daily to the ships at Newport and Melville and to activities in the immediate area.

The ships at Davisville, Providence, and Fall River receive one delivery daily. The total RAMAC and issue system improvement has enabled the Depot to deliver items within four to five hours after the invoice is received instead of the ten to twelve days formerly required.

The RAMAC installation at the Naval Supply Depot has proven very successful, and the Supply Department, Naval Shipyard, Charleston, South Carolina, is now installing a RAMAC and will use the same systems as used at Newport.

Some of the improvements planned at Newport to expedite service to the fleet are to install a transceiver at Pier I, Newport, which is about 1,000 yards from the Main Supply Building, with cables leading directly into the RAMAC. Request documents will be handled through a transceiver operator, who will key-punch the information directly into the RAMAC, and the RAMAC will produce all documents required for issue of the material. A printing punch will be installed in the warehouse to signal the warehouseman and give him information so he can pick the material. By the time the requestor can get from the pier to the warehouse, the material will be waiting for him. This entire procedure takes about three minutes and will be used for priority requisitions.

The International Business Machines Corporation is now perfecting an additional storage unit for the RAMAC that will enable the storage of up to 40,000 items per unit. If these units are perfected, the Naval Supply Depot, Newport, could install sufficient units to place all items in memory. Another

possibility in the field of additional storage on the present RAMAC is to cut more deeply into the core of the memory disc to gain additional storage. The present disc is eighteen inches in diameter, and only the outer five inches are used for storage. If this depth were increased, additional storage would result. Of the two methods discussed, it is not known which will be perfected and applied to RAMAC installations in the supply system.

EDPM at the Ships' Parts Control Center, Mechanicsburg, Pennsylvania

For the study of an EDPM application at a Supply Demand Control Point, the application at the Ships' Parts Control Center at Mechanicsburg, Pennsylvania, was chosen. The Ships' Parts Control Center is responsible for administering the ships' parts segment of the Navy Supply System. Its responsibility covers the supply control application for determination of requirements, procurement and allocation requirements, determination and disposition of excess, and the distribution of material. It is also responsible for cataloguing, preparation and maintenance of allowance lists, and related matters.

The Ships' Parts Control Center is manned by 1,354 civilian and military personnel and has a total annual operating cost of $7,200,000. The Center manages an inventory of 181,000 stock items with a value of $495,000,000. With the mission of the Center and the inventory figures, it can easily be seen that the Ships' Parts Control Center provided an excellent spot for an EDPM application. In addition to the above figures, in 1955, 34,000,000 punched cards were required

to adjust inventory records, compute activity system requirements, determine budget requirements, publish ships' parts catalogues, prepare vessel load lists, and maintain technical engineering data.

A study of EDPM was made, and by August, 1954, a justification for EDPM was made, and it was decided that the following could be accomplished:

1. Implementation of a transaction reporting system and use the machines as a tool for management by exception;

2. A one-time savings by a reduction of the investment in inventory;

3. Better budget forecasting with more timely and meaningful information;

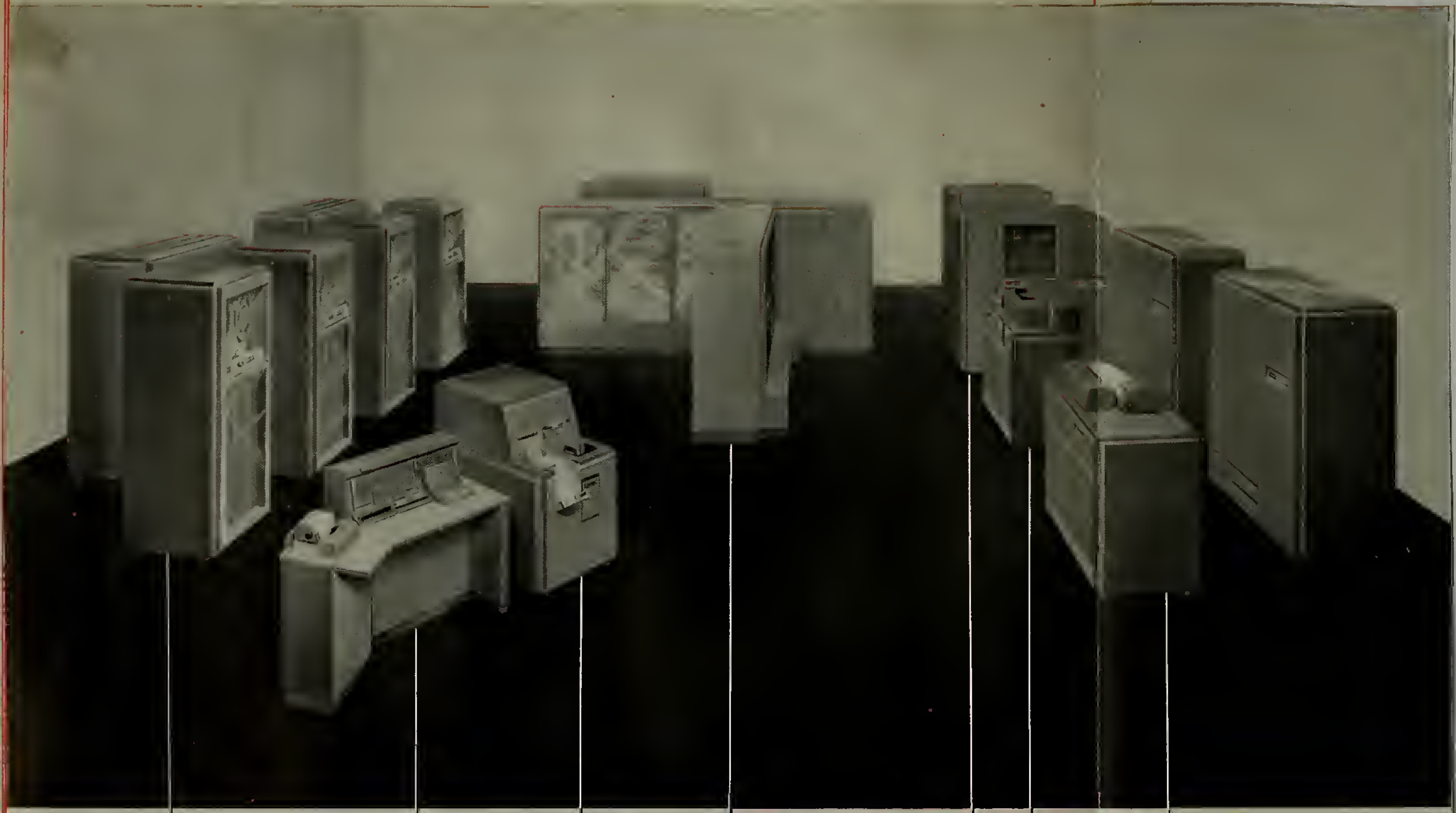
4. Maintenance of catalogue and technical record files, and the use of the EDPM in the conversion to Federal Stock Numbers;

5. An orderly expansion in the event of mobilization;

6. Reduction of electronic accounting machine personnel;

7. Electronic accounting machine equipment releases.

On 14 August, 1956, the IBM Type 705, Figure 11, integrated system of record reading and writing devices interconnected through a central processing unit was officially installed. Some of the costs incurred by the Ships' Parts



AN INSTALLATION OF IBM ELECTRONIC DATA-PROCESSING MACHINES
TYPE 705 AND ASSOCIATED EQUIPMENT

Fig. 11.--IBM 705

Control Center prior to the actual installation and operation of the machines were:

1. Air conditioning for the installation - $ 96,000
2. Personnel training - 72,000
3. Analysis effort - 81,500
4. A supply of magnetic tap reels (1,000)- 50,000
5. The assembly of master tape records - 129,000

Some of the process procedures used at the Ships' Parts Control Center are discussed below; they are not a complete coverage of all processes nor are they intended to be a 100% detailed explanation of the entire process:

1. The Perpetual Inventory Record was established on magnetic tapes from punched cards and serves as the master record for all stock control and related functions.

2. The Contract Status Record was developed on tape and sequenced by type of source document and delivery dates.

3. Perpetual Inventory and Contract Stock Records are kept up-to-date for medium, slow moving, and insurance items through the Ships' Parts Control Center and Field Activity changes, which are received daily or less frequently as transactions occur.

4. A File Maintenance Run is made weekly to update the Perpetual Inventory Record from transaction details and stock list details converted to tape. In the first run the tapes are merged and in the second run the following actions

are accomplished:

a) The Perpetual Inventory is updated. (Weekly)

b) A Consolidated Stock Status Report tape is created and edited for interrogation. (Weekly)

c) A Record of Change tape is created, tailored to reporting activities for certain change codes. (Quarterly)

d) Creation of a Perpetual Inventory Record Stock Consolidation tape. (Quarterly)

e) Creation of a work tape for medium and slow moving items that had action during the period. (Weekly)

f) Creation of an edited Consolidated Stock Status Report for insurance items which have had action in the preceding bi-weekly period. (Bi-weekly)

5. a) A Bi-weekly Stock Analysis Run is made to:

(1) Compute activity requirements and excesses.

(2) Test activities status for criteria acceptance.

(3) Determine critical items.

(4) Compute system requirements for medium and slow moving items.

(5) Create a work tape for the next run.

b) In the Stock Analysis Run the following action is taken:

(1) Initiation of redistribution for medium and slow moving items.

(2) Creation of a tape for redistribution and reallocation of critical items.

(3) Updating Perpetual Inventories by quantities redistributed and reallocated after the completion of review by stock control.

(4) Updating the contract Status Record for quantities reallocated after the completion of the review of EDPM action by Stock Control.

(5) Creation of a worktape for the third run.

c) The third machine run is made to:

(1) Compute system requirements for excesses for medium moving items.

(2) Determine and allocate procurement quantities.

(3) Create a procurement action tape.

(4) Update Perpetual Inventory Records.

(5) Create an edited Consolidated Stock Status Report on medium and slow moving items.

6. For fast moving items the Perpetual Inventory Record is updated quarterly through the EDPM Branch operations and the Stock Control Division. In the EDPM Branch the processes are similar to the above processes for medium and slow moving items except that more study is made of activity inventories, proposed supply action is initiated, the procurement formula is applied to determine the system excesses or deficiencies, and an Electronic Accounting Machine Card is

prepared for each critical, procurement, reallocation, and redistribution action. In the Stock Control Division, the EDPM action is reviewed, and any changes are noted and sent back to EDPM for correction or updating as required. Items that do not lend themselves to automatic processing are manually screened for procurement action.

Some of the reports produced by the IBM 705 that aid in facilitating more effective supply control at the Ships' Parts Control Center are:

1. The Consolidated Stock Status Report which is a consolidation of all individual stock status reports of all Ships' Parts Control Center stock status reporting activities reflecting issue history, stock list and technical information, and mobilization reserve quantities;

2. Replenishment Recommendations that indicate parts that should be procured for stock;

3. Shipment Order Request that is forwarded to consignor and consignee activities indicating material to be redistributed;

4. Critical Items Report indicating the items in critical short supply;

5. The Delinquent Replenishment Recommendations Report that shows the recommendations for replenishment that have not been negotiated into contracts and are in excess of ninety days old.

6. The Report of Contract Delinquent Items reporting

by manufacturers of contract line items that are delinquent in excess of thirty days;

7. The Report of Surplus Disposal Recommendations;

8. The Surplus Disposal Statistics Report; and

9. The Best Seller Report showing items in descending sequence according to the quantity of replenishment demand during the past five years.

The EDPM installation has made definite accomplishments in all the fields proposed at the time the Ships' Parts Control Center justified the conversion. These accomplishments are:

1. A transaction reporting system has been implemented, and the EDPM is providing a means of management by exception;

2. There has been a one-time savings by the reduction of the investment in inventory due to a thirty day reduction in the lead time of 5,500 slow, medium and insurance items. The dollar value of the savings was $736,000 through November, 1957;

3. Better budgeting has been achieved at the Ships' Parts Control Center through the use of more timely and meaningful information produced by the EDPM. In the budget computations of the requirements and the analysis of the system inventory, 170,000 items were processed resulting in 43,850,000 calculations by the EDPM;

4. The maintenance of catalogue and technical record files by EDPM has made it possible to keep these files up-to-date on a monthly basis which is a great improvement over the six months' period required prior to the EDPM installation;

5. In the event of mobilization, the EDPM would be utilized to compute the increased mobilization material required for a completely activated fleet. Reserve fleet ships' needs, advanced base initial outfitting lists, and the items needed for mobile logistics support are included in the integrated EDP files at the Ships' Parts Control Center.

6. By the use of the EDPM in place of the electric accounting machines, the Ships' Parts Control Center has reduced the 195 Electronic Accounting Machine personnel to 128 EDPM and Electronic Accounting Machine personnel, for a $50,000 per year net savings;

7. Thirty-four electric accounting machines have been released, and the annual electric accounting machines rental has been reduced by $152,000.

The achievements of the EDP installation in the preceding paragraph should not be construed to mean that the installation has reached a point of perfection. There are still many improvements to be made on the procedures and the related procedures at the field activities before anything near perfection may be attained. As the operation progresses, there are additional applications that might serve management in bringing about a more effective supply operation for ships' parts. Some of these are:

1. The development of procedures to provide for the machine to determine fraction code assignments. It is indicated that this may be done as a bi-product of another

report and will effect considerable savings of manpower and time;

2. An improved system for distribution of stocks at stocking points, thereby reducing redistribution and reallocation actions;

3. Under the development of the allowance parts lists, the use of component and item population data will provide a basis for the improved distribution of stocks;

4. A study of the use of the EDPM to mechanize the determination of substitute and superseded items;

5. The machine projection of material planning requirements for overhaul and repair programs;

6. The automatic determination of standard prices;

7. Development of stocking programs for field activities;

8. Development of procurement history records and procurement formulas with further applications of "economic buy" principles; and

9. Implementation of a transceiver network with ultimate tape-to-tape transmission in lieu of punched cards and shipment orders.

CHAPTER IV

EDP APPLICATIONS TO FINANCIAL AND ACCOUNTING OPERATIONS

General

The applications of the EDPM to financial and accounting activities has not progressed to the extent of the supply applications. These are card operated IBM 650 installations at three Supply Demand Control Points, one Supply Center, and one Supply Depot; another installation at the Naval Supply Depot, Bayonne, New Jersey, is scheduled for the summer of 1958.

The Supply Demand Control Points use the card operated machines primarily for inventory control purposes, but those with larger EDPM installations use the 650 for payrolls, bond accounting, allotment accounting, cost distribution, budget planning and review, and cost reporting. At the Naval Supply Center and the Naval Supply Depots, the card operated 650's are used for the same purposes as at the Supply Demand Control Points with the only inventory application being in the stock record keeping area, which is limited to the processes involved in updating stock balance cards and preparing stock transaction registers.

The depot installations for the accounting and fiscal applications make savings of about $30,000 to $50,000 per year

possible and, in addition, there are intangible benefits that accrue to the depot itself and to its customers. The EDPM has been installed to take advantage of the electronic systems that are available, and to provide their personnel with experience in programming and operating a stored program computer. Although the card operated 650 does not solve the inventory problems, the applications have proven beneficial in the fiscal operation.

EDP and the Naval Finance Center

The Naval Finance Center at Cleveland, Ohio, offers a great potential for savings in the fiscal and accounting fields. The Naval Finance Center handles all naval personnel allotment records, pays all allotment checks and bonds, pays retired and fleet reserve personnel, audits Navy pay records, acts as a custodian for savings bonds, handles the Uniformed Services Contingency Option Act Report preparation, and other record keeping and accounting functions. The volume of work involved in these functions will clarify the meaning of the title "Navy Finance Center." The following table shows the volume required to accomplish the following functions:

TABLE 5

VOLUME OF WORK--NAVY FINANCE CENTER

Total Allotment Records Maintained	1,364,400
Monthly Allotment Transactions (Starts and stops)	90,300
Monthly Payments--Blanket (202 checks)	271,000
Individual Checks Monthly	406,000

TABLE 5-*Continued*

Savings Bonds Monthly	147,000
Savings Bonds Quarterly	85,000
Monthly Allotment Transactions (Address changes, correspondence, corrections, etc.)	68,500
Pay Record Zero Balancing and Analysis	$21,500

In April, 1955, the Naval Finance Center forwarded a letter concerning the feasibility of an EDPM installation, and covering the overall theory and application for the Center. In May, 1955, the Center was authorized to organize a fully staffed committee to determine the specific equipment for an EDPM installation. This committee was to be composed of Naval Finance Center personnel on an extra assignment basis, but an increase of five additional personnel in the ceiling was authorized for the study if they were needed. The personnel were authorized to travel to manufacturers' plants, attend schools, and visit activities having EDPM installations. By July, 1956, the committee had completed and submitted a brochure showing that a large EDPM system was desirable and:

1. It would result in a net savings of approximately $250,000 per year.

2. That of the fifteen EDP systems evaluated, the IBM 705 was rated best for performance and economy, and the UNIVAC I was rated second.

A month later the brochure was amended and an IBM 705 was definitely recommended for installation. The Bureau of Supplies and Accounts approved the IBM 705 and authorized the

Naval Finance Center to establish a permanent organization and make definite plans for the installation.

Since then, the Navy Management Office and the Assistant Secretary of Defense (Comptroller) have discussed the matter of equipment and installation; however, at this time there is no EDPM installation at the Naval Finance Center. An installation is scheduled for March, 1959, but no definite equipment has been selected yet.

When the EDPM system is installed at the Naval Finance Center, the following applications are considered to be feasible for conversion:

1. Allotment Registration. This covers the procuring of all allotment transactions, discontinuances, address changes, and the establishment of magnetic tape files for the Accounting Record, Accounting Card, Stencil, and Bond Custody;

2. Allotment Issuances. This includes the printing of the 406,000 allotment checks each month, printing the listings for Government Insurance, bank and insurance company payments, and the printing of all monthly vouchers for all allotment payments;

3. Pay Record Zero Balancing and Analysis. This includes the zero balancing of the debits and credits on the Military Pay Records with the accumulation of all data including appropriation, tax and allotment information;

4. Pay Record--Allotment Audit. This is the reconciliation of pay record checkages against allotment payments.

5. Retired and Fleet Reserve Check Issuances;

6. Uniform Services Contingency Option Act Reports. This is a tabulation of the data required in connection with the reports and records necessary; and

7. Personnel Accounting Machines Installation File. This application is considered to be marginal, and it includes a locator file containing a current address for each serviceman in the Navy.

If an EDPM is installed, and the above applications are established, the estimated monthly rentals of the equipment are $26,907 per month for the IBM Xerox System and $28,384 per month for the UNIVAC I--Printer Punch System. In consideration of the personnel savings, it is estimated that the IBM 705 will enable $49,555 in payroll costs to be saved monthly, and an overall net savings of $18,583 per month. The UNIVAC I will result in a payroll savings of $53,657 per month with an overall net savings of $22,367 per month. These estimated savings are considered conservative and do not include savings that cannot be measured in dollars easily, as:

1. Savings to be realized through the application of other minor Center operations to the EDPM;

2. Savings attributable to other Naval Finance Center intermittent assignments;

3. Savings due to the reduction of clerical errors;

4. Savings contingent on future administrative decisions as the issuance of a punched card savings bond; and

5. Savings to be realized through the rental of unused computer time to the Navy Regional Accounts Office, Cleveland, and to the Bureau of Naval Personnel Family Allowance Activity.

In addition to the applications for the computer listed above, some of the future applications possible for consideration at the Naval Finance Center are:

1. The centralization of the 160,000 Reserve Drill Pay Accounts that are now carried at the Navy Accounts Disbursing Offices and at some of the major air stations. These accounts require payment quarterly and would be updated and cycled at times when the computer was not being used in other applications; and

2. The centralization of all 800,000 pay records for naval personnel. This would eliminate the maintenance of the pay cards at each activity by the Disbursing Officer. The Disbursing Officer would make payments and forward pay vouchers to the Naval Finance Center where the pay record would be maintained.

The application of the EDPM for financial and accounting operations throughout the Navy appears to be very practical for activities with a sufficient volume of business to justify them. In supply activities where the machines are installed primarily for supply and inventory control, the financial operations could be programmed and accomplished during the unscheduled time on the machines. However, care must be taken to insure that the

primary mission of the installation is not crowded out and rendered inefficient due to other usages of the computers. In many of the large centers and depots, it may prove more feasible to install separate EDPM systems, one for inventory and stock control and the other for financial accounting.

CHAPTER V

THE FUTURE OF ELECTRONIC DATA PROCESSING

The development of the EDPM during the past eight years from its infancy to its present stature has been fantastic. Considering the speed, the results being attained, the new application possibilities, and the machine reliability, we can readily understand how EDPMs will cause a profound change in office procedures, methods of scientific calculations, and the production of masses of data for management use to analyze its requirements realistically and comprehensively. In the Navy Supply System the objective to be attained by the use of the EDPM is the capability of the machines to provide the most effective data handling techniques and the maximum amount of useful management information.

The future of the EDP usage is closely tied to the future technicological improvements that can be made in the machines. One of the major advances, already used in pocket radios and in some experimental computers, is the use of the transistor in place of the vacuum tube. The advantages of the transistor are that it is much smaller, has a much longer life than the vacuum tubes, and increases the reliability of the unit. Other advances are the manufacturing technique of printed

circuits and automatic devices to wire electronic circuits. These will eliminate errors in computer fabrication thereby saving untold hours of labor and will be a major factor in decreasing the cost of computers. These improvements and others to be developed will aid in the production of computers that will be small, cheap, use little power, give out little heat, and have extremely reliable operating characteristics.

The latest developments in computer design and those to be made in the near future make it probable that all naval vessels will be equipped with some type of computer or computer system within the next ten years. On larger ships, as aircraft carriers, a complete computer system could be installed; and a smaller single unit system could be installed on the smaller ships. The computer system would necessarily be small, compact, and very substantially constructed for seaworthiness.

Conceivable uses for shipboard installations include mechanization of personnel, pay, supply, spare parts, and other inventory records. Rapid logistic support could be attained by the use of transceivers or other radio techniques that would read requirements into the computer system aboard supply ships or at supply activities and initiate the physical movement of requested items within minutes. This procedure could be accomplished on a world-wide basis making possible indeterminable savings in inventory costs and increased military efficiency. A truly centralized personnel control and Navy-wide inventory control system could be perfected. Other computations such as navigational problems, fuel usage, machinery maintenance

control, missile guidance and tracking, and fire control problems could be solved rapidly. Another possibility is a complete ship operation, both bridge and engine room procedures, by computer control. A ship could be steered automatically by punched tape or card control with automatic course changes as directed by the card or punched tape or, as necessary, due to wind or current variances calculated, by the computer. There could be radar integration that would warn the computer of approaching vessels or objects so that the computer could take automatic action as required.

The system design and logic of the electronic computer of the future is difficult to predict. Future machine changes depend upon operating experience and the requirements of the users. This requires a closer coordination of the design engineers and the business system personnel than there is at present. The achievement of really automatic data processing will come into being when computers are used for storage of data and for actual on-line or real time data processing. This means that data may be fed into the computers from a variety of sources, and that the arithmetical and logical sections will be time-shared among a large variety of operations. With the fantastic speed of the computers possible, this will allow for a centralized computer to have complete cognizance and control over all basic data processing functions within a company on a continuous basis.

With all of the systems improvement in EDP, the computers will benefit management only to the extent that

CHAPTER VI

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

Electronic data processing machines have demonstrated their ability to handle most of the clerical type functions in the Navy Supply System. These functions can be adapted to the EDPM with few changes being required. Already most of the Supply Demand Control Points have an EDPM system operating or on order, the large supply centers ~~will~~ be converted to the EDPM ~~within~~ a year, and the supply depots and supply departments of major industrial activities have begun EDPM conversions.

EDPM installations are expensive; the feasibility studies, the training of personnel, the programming, and the site preparation require a considerable outlay of manpower and money prior to the actual installation of the machines. In the Navy's feasibility studies, it has been concluded that these expenditures will be compensated for by the savings of clerical personnel and electronic accounting machine rentals. Throughout the Navy, the results of the EDPM installations have effected the savings, that were ~~estimated in the feasi-~~ bility studies. Added benefits that accrue with the EDPM

installations are:

1. Efficient supply support with faster processing of supply procedural documents;

2. More reliable information furnished to management for decision making;

3. The reduction of personnel and office space requirements; and

4. The increased mobilization potential for the supply support of the Navy.

One other important application of the EDPM is its effect on operations research. Usage data figures, allowance lists, stocking policies, and procurement policies are used in operations research, and through EDP, they can be integrated and analyzed much more efficiently than ever before. These analyses produce results that allow savings of funds and give added efficiency to the supply system.

Recommendations

The Navy Supply System has adopted the EDPM and is well advanced in their installations. The following recommendations that will strengthen the Navy Supply EDPM program are offered:

1. That the Bureau of Supplies and Accounts continue studies of EDPM applications with the aid to determine the integration of the issue-stock control procedures with the financial accounting and related procedures;

2. That the Bureau of Supplies and Accounts institute a more widespread program for training Supply Officers on EDP. This program should be as extensive as possible so that

officers in all ranks receive the minimum of an introductry course to EDP. EDP should be included in the curriculum of all Supply Corps Schools and the graduate schools attended by Supply Corps Officers. EDP instruction should be emphasized at supply and financial management field conferences. Supply information media such as the *Newsletter* should increase their coverage of EDP applications and progress. Top supply and financial managers should receive instructional and informational literature on the developments and projects concerning EDP.

3. That the training of civilian and enlisted personnel should be increased and expedited so that the Navy will have sufficient personnel for expansion and in the event of mobilization.

4. That long range planning for EDPM applications be formulated to cover periods of two to five years, five to ten years, and mobilization if it becomes necessary. These plans would require constant updating to keep current with technical and procedural advances that are being made.

5. That further studies of EDP application to Mobile Logistics Support be undertaken with the aim to determine the nearest echelon in the support structure to the operating forces where EDP would be feasible.

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